

CLAIMS

1. A probe for measuring an electric potential of a cell, said probe being arranged to be used with a sucking device, said probe comprising:

5 a plate having a surface, the plate having a first cavity provided in the surface of the plate, a second cavity, and a first flow passage provided in the plate, the first cavity having a bottom surface, the second cavity being provided in the bottom surface of the first cavity, the first flow passage having a first opening and a second opening, the first opening of the first flow passage opening to the second cavity, the second opening of the first flow
10 passage opening outside the plate; and

a sensor element provided in the first cavity, the sensor element including

a thin plate having a first surface and a second surface opposite to the first surface of the thin plate, the thin plate having a
15 through-hole provided therein, the through-hole having a first opening and a second opening, the first opening of the through-hole opening to the first surface of the thin plate, the second opening of the through-hole opening to the second surface of the thin plate and connected with the second cavity of the plate, and

20 a supporting substrate provided around the thin plate and in the first cavity of the plate,

wherein the first flow passage allows fluid to flow therein, and the sucking device is arranged to be coupled with the second opening of the first flow passage so as to suck the fluid flowing in the first flow passage.

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2. The probe of claim 1, wherein the bottom surface of the first cavity and the second surface of the thin plate of the sensor element are flush with

each other.

3. The probe of claim 2, wherein

the supporting substrate of the sensor element have a first
5 surface and a second surface, the first surface of the supporting substrate
facing towards a direction identical to a direction towards which the surface
of the plate faces, the second surface of the supporting substrate is provided
on the bottom surface of the first cavity of the plate, and

a third cavity is provided on the first surface of the thin plate.

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4. The probe of claim 1, wherein the supporting substrate of the
sensor element is bonded to the plate.

5. The probe of claim 1, wherein the plate further have a second flow
15 passage provided therein, the second flow passage having a first opening and
a second opening, the first opening of the second flow passage opening to the
second cavity, the second opening of the second flow passage opening outside
the plate.

20 6. The probe of claim 5, wherein the second opening of the second flow
passage is arranged to be coupled to a pouring device, and the pouring device
is operable to put fluid into the second opening of the second flow passage.

7. The probe of claim 6, wherein a valve is arranged to be connected
25 between the pouring device and the second flow passage.

8. The probe of claim 5, wherein the second flow passage has a

sectional area not smaller than 0.01mm².

9. The probe of claim 5, wherein the second flow passage has a curved portion.

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10. The probe of claim 5, wherein the plate includes a bump which is provided between the first flow passage and the second flow passage and which projects toward the second cavity.

10 11. The probe of claim 1, wherein the first flow passage has a sectional area not smaller than 0.01mm².

12. The probe of claim 1, wherein the first flow passage has a curved portion.

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13. The probe of claim 1, further comprising electrodes provided on the sensor element around the first opening of the through-hole and the second opening of the through-hole, respectively.

20 14. The probe of claim 1, wherein the thin plate of the sensor element has a pocket provided therein at at least one of the first opening of the through-hole and the second opening of the through-hole of the thin plate, the pocket having a diameter larger than a diameter of the through-hole of the thin plate.

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15. The probe of claim 1, wherein the plate comprises material transmitting visible light therein.

16. The probe of claim 1, wherein the thin plate of the sensor element comprises material transmitting visible light therein.

5 17. The probe of claim 1, wherein the plate includes a bump projecting toward the second cavity.

18. The probe of claim 1, wherein the surface of the plate and the first surface of the thin plate of the sensor element are flush with each other.

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19. The probe of claim 18, wherein

the supporting substrate of the sensor element have a first surface and a second surface, the first surface of the supporting substrate facing towards a direction identical to a direction towards which the surface of the plate faces, the second surface of the supporting substrate is provided
15 on the bottom surface of the first cavity of the plate, and

a third cavity is provided on the first surface of the thin plate.

20. The probe of claim 1, further comprising

20 a well array having a first well, a second well, and a third well provided therein, the first well, the second well, and the third well having openings and bottom surfaces, respectively, wherein

the bottom surface of the first well has a through-hole which is provided therein and which communicates with the second opening of the
25 first flow passage,

the bottom surface of the second well has a through-hole which is provided therein and which communicates with the through-hole of the thin

plate of the sensor element, and

the bottom surface of the third well has a through-hole which is provided therein and which communicates with the second opening of the second flow passage.

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21. The probe of claim 20, wherein the through-hole of the second well tapers toward the through-hole of the thin-plate of the sensor element.

22. The probe of claim 20, further comprising:

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a first electrode provided in the second well; and

a second electrode provided in one of the third well and the first flow passage.

23. The probe of claim 20, wherein

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fluid including a target cell is input in the second well,

fluid for detecting reaction with the target cell is input into the third well, and

the first well is coupled to the sucking device.

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24. The probe of claim 20, wherein the second well is provided above the first surface of the thin plate of the sensor element.

25. The probe of claim 24, wherein the through-hole of the second well has a size larger than a size of the thin plate.

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26. The probe of claim 20, wherein the through-hole of the first well is larger than the second opening of the first flow passage.

27. The probe of claim 20, wherein the through-hole of the third well is larger than the second opening of the second flow passage.

5 28. The probe of claim 20, wherein the well array has a bottom surface, the bottom surface of the well array having the through-hole of the first well, the through-hole of the second well, and the through-hole of the third well open thereto, the bottom surface of the well array and the surface of the plate is positioned in a plane.

10 29. The probe of claim 20, wherein the well array comprises material identical to material of the plate.

15 30. The probe of claim 20, wherein the plate and the well array comprise glass or quartz.

 31. The probe of claim 20, wherein the plate and the well array comprise polystyrene, cycloolefin polymer, or cycloolefin copolymer.

20 32. The probe of claim 20, wherein the plate and the well array comprise thermoplastic resin.

 33. The probe of claim 20, further comprising:
 another plate having a plurality of openings provided therein; and
25 another sensor element including another thin plate, the another thin plate having a plurality of through-holes opening in a direction identical to a direction in which the plurality of openings of the another plate open,

wherein the well array further has a plurality of other well arrays, each of the other well arrays having bottom surfaces, the bottom surfaces of the other well arrays having a plurality of through-holes provided therein, respectively, and the plurality of through-holes of the other well arrays
5 communicate with the plural openings of the another plate and the plurality of through-holes of the sensor element, respectively.